WE CLAIM:

1. Polymer comprising units derived from ethylene, said polymer having:

   a)   a Melt Index of from 0.05 to 20 g/10 min as determined by ASTM-1238 Condition E;

   b)   at least 10 per 1000 C-atoms of C1- to C5 short chain branches as determined by C13 NMR, and 0 to 3.5 mol % of units derived from a copolymerizable ethylenically unsaturated ester,

   c)   a density of from 0.90 to 0.94 g/cm³, preferably 0.91 to 0.935 g/cm³, especially 0.92 to 0.93 g/cm³ as determined by ASTM D1505, and

   d)   a rheological relaxation time of at least 10 s.

2. Polymer as claimed in Claim 1 which contains at least four short chain branches per thousand carbon atoms containing three carbon atoms or less.

3. Polymer as claimed in Claim 1 which contains at least five short chain branches per thousand carbon atoms containing three carbon atoms or less.

4. Polymer as claimed in Claim 1 which contains less than 30 per 1000 C-atoms of short chain branches, containing five carbon atoms or less, as determined by C13 NMR.

5. Polymer as claimed in Claim 1 which contains less than 20 per 1000 C-atoms of short chain branches, containing five carbon atoms or less, as determined by C13 NMR.

6. Polymer as claimed in Claim 1 wherein the polymer contains from 1 to 3 mol % of units derived from a copolymerizable ethylenically unsaturated ester.

7. Polymer as claimed in Claim 1 wherein the polymer contains at least 1 per 1000 C-atoms of all long chain branches, containing 6 or more carbon atoms as determined by C13 NMR.

8. Polymer as claimed in Claim 1 wherein the polymer contains at least 5, per 1000 C-atoms of all long chain branches, containing 6 or more carbon atoms as determined by C13 NMR.

9. Polymer as claimed in Claim 1 wherein the polymer contains from 1 to 3 mol % of units derived from a copolymerizable ethylenically unsaturated ester and at least 1 per 1000 C-atoms of all long chain branches, containing 6 or more carbon atoms as determined by C13 NMR.

10. Polymer as claimed in Claim 1 wherein the polymer has a bimodal molecular weight distribution as determined by GPC DRI.

11. Polymer as claimed in Claim 1 wherein the polymer has a relaxation time is less than 20 s.

12. Polymer as claimed in Claim 1 wherein the polymer has a Melt Index of less than 15 g/10 min.

13. Polymer as claimed in Claim 1 wherein the polymer has a Melt Index of less than 10 g/10 min.

14. Polymer as claimed in Claim 1 wherein the polymer has a Melt Index of from 0.1 to 4 g/10 min for blown film extrusion.

15. Polymer as claimed in Claim 14 wherein the polymer has a Melt Index of less than 2 g/10 min.

16. Polymer as claimed in Claim 14 wherein the polymer has a Melt Index of less than 1 g/10 min.

17. Polymer, comprising units derived from ethylene, obtained by free radical polymerization using a chain transfer agent that incorporates into the polymer chain such as an alpha-olefin to provide a polymer having a Melt Index of from 0.05 to 20 g/10 min as determined by ASTM-D 1238 Condition E; and at least 10 per 1000 C-atoms of short chain branches, containing five carbon atoms or less, as determined by C13 NMR.

18. Polymer as claimed in Claim 17 wherein the chain transfer agent that incorporates into the polymer chain is propylene.

19. Polymer as claimed in Claim 17, which comprises less than 3.5 mol % of units derived from a copolymerizable ethylenically unsaturated ester.

20. Polymer according to Claim 17 in which the polymer is produced in a tubular reactor under circumstances to favor LCB formation in a down stream part of the tubular reactor and has a density of from 0.90 to 0.94 g/cm^3.

21. Polymer according to Claim 20 in which the polymer has a density of 0.91 to 0.935 g/cm^3 as determined by ASTM D1505, and a relaxation time as described herein of at least 10 s.

22. Polymer according to Claim 20 in which the polymer has a density of 0.92 to 0.93 g/cm^3 as determined by ASTM D1505.

23. Free radical polymerization process comprising feeding ethylene and a copolymerizable ethylenically unsaturated ester and propylene as a chain transfer agent, under conditions favoring formation of short chain branches by backbiting and propylene incorporation to provide a polymer having a Melt Index of from 0.05 to 20 g/10 min as determined by ASTM-D 1238 Condition E.

24. Free radical polymerization process as claimed in Claim 23 comprising less than 3.5 mol % of units derived from the copolymerizable ethylenically unsaturated ester.

25. Process as claimed in Claim 23 wherein the polymer has a density of from 0.90 to 0.94 g/cm³ as determined by ASTM D1505.

26. Process as claimed in Claim 23 wherein the polymer has a density of 0.91 to 0.935 g/cm³ as determined by ASTM D1505.

27. Process as claimed in Claim 23 wherein the polymer has a density of from 0.92 to 0.93 g/cm³ as determined by ASTM D1505.

28. Process as claimed in Claim 23 wherein the polymer has a relaxation time as described herein of at least 10 s.

29. Process as claimed in Claim 23 wherein the polymer contains from 1 to 3 mol % of units derived from a copolymerizable ethylenically.

30. Process as claimed in Claim 23 wherein the polymer contains at least 1 per 1000 C-atoms of long chain branches, containing 6 or more carbon atoms as determined by C13 NMR.

31. Process as claimed in Claim 23 wherein the polymer the polymer has a bimodal molecular weight distribution as determined by GPC DRI.

5   32. Process as claimed in Claim 23 wherein the polymer has a Melt Index of less than 15 g/10 min.

33. Process as claimed in Claim 23 wherein the polymer has a Melt Index of less than 10 g/10 min.

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34. Process as claimed in Claim 23 wherein the polymer has a Melt Index of from 0.1 to 4 g/10 min for blown film extrusion.

35. Process as claimed in Claim 34 wherein the polymer has a Melt Index less than 2

15   g/10 min.

36. Process as claimed in Claim 34 wherein the polymer has a Melt Index of less than 1 g/10 min.

20   37. Process as claimed in Claim 23 wherein the polymer has at least 10 per 1000 C-atoms of short chain branches, containing four carbon atoms or less, as determined by C13 NMR.

38. Process as claimed in Claim 23 wherein the polymerization is performed in a

25   tubular reactor at from 2200 to 2700 bar and from 180 to 330 °C with multiple injection of feed and initiator but with reduced or no injection of monomer at a downstream reaction zone.

39. Process as claimed in Claim 38 wherein the polymerization is performed with no or reduced injection of transfer agent at a downstream reaction zone.

40. Process as claimed in Claim 38 wherein a final temperature peak at a downstream reaction zone with reduced or no monomer injection is in excess of the temperature peak of at least two temperature peaks at two reaction zones upstream of the final reaction zone.

41. Process as claimed in Claim 38 wherein a final temperature peak at a downstream reaction zone with reduced or no monomer injection is in excess of the temperature peak of at least one temperature peak at a reaction zone upstream thereof at which monomer is injected.

42. Stretch hood packaging process using a polymer as claimed in Claim 1 formed into a multi-layer film capable of TD stretching by at least 100 % and retention around a load by subsequent elastic recovery.

43. Stretch hood packaging process using a polymer obtained by a process according to Claim 23 and formed the polymer into a multi-layer film capable of TD stretching by at least 100 % and retention around a load by subsequent elastic recovery.

44. Multi-layer film comprising a main layer with at least 50 wt %, based on the total weight of polymers in the main layer, of a polymer as claimed in Claim 1, said film having an elastic recovery after a 100 % stretch of at least 40 % and providing a normalized holding force per 100 μm thickness pre-stretch at 85 % stretch, after an initial stretch of 100 %, of at least 20 N/50 mm.

45. Film as claimed Claim 44 wherein the film can be extended up to 100 % while providing a minimum tensile test slope of at least 0.01 MPa per % elongation.

46. Film as claimed Claim 44 wherein the Secant modulus of the un-stretched film is less than 180 MPa.

47. Film as claimed Claim 44 wherein the Secant modulus of the un-stretched film is less than 120 Mpa.

48. Film as claimed Claim 44 wherein the film has a multi-layer structure (such as a three or five layer structure) with a skin layer arranged to one or both sides of the main layer comprising a linear low density ethylene copolymer (LLDPE) having a density of from 0.91 to 0.94.

49. Film as claimed Claim 44 wherein the film has a multi-layer structure with a skin layer arranged to both sides of the main layer, said skin layer comprising a linear low density ethylene copolymer (LLDPE) having a density of from 0.91 to 0.94, in which the structure is an A/B/C structure where C may be the same or different as A.

50. Film as claimed Claim 44 which is made by blown film extrusion in tubular form adapted to form a stretch hood upon stretching in a transverse direction, which is capable of extension to at least 100 % at an overall deformation rate in excess of 12 % of the original starting length per second at constant cross-head speed.

51. Multi-layer film comprising a main layer with at least 50 wt %, based on the total weight of polymers in the main layer, of a polymer obtained by a process as claimed in Claim 23, said film having an elastic recovery after a 100 % stretch of

at least 40 % and providing a normalized holding force per 100 μm thickness pre-stretch at 85 % stretch, after an initial stretch of 100 %, of at least 20 N/50 mm.

52. Film as claimed in Claim 51 wherein the film can be extended up to 100 % while providing a minimum tensile test slope of at least 0.01 MPa per % elongation.

53. Film as claimed in Claim 51 wherein the Secant modulus of the un-stretched film is less than 180 MPa.

54. Film as claimed in Claim 51 wherein the Secant modulus of the un-stretched film is less than 120 Mpa.

55. Film as claimed Claim 51 wherein the film has a multi-layer structure (such as a three or five layer structure) with a skin layer arranged to one or both sides of the main layer comprising a linear low density ethylene copolymer (LLDPE) having a density of from 0.91 to 0.94.

56. Film as claimed Claim 51 wherein the film has a multi-layer structure with a skin layer arranged to both sides of the main layer, said skin layer comprising a linear low density ethylene copolymer (LLDPE) having a density of from 0.91 to 0.94, in which the structure is an A/B/C structure where C may be the same or different as A.

57. Film as claimed Claim 51 wherein made by blown film extrusion in tubular form adapted to form a stretch hood upon stretching in a transverse direction, which is capable of extension to at least 100 % at an overall deformation rate in excess of 12 % of the original starting length per second at constant cross-head speed.

58. Film having a coefficient of friction of from 0.2 to 1 for stretch hood packaging comprising:

    a)   a core polymeric layer; and

    b)   a skin layer, on each side of the core which may be of the same or different composition, comprising at least 60 wt % of an LLDPE having density of 0.91 to 0.94 g/cm^3 as determined by ASTM-D 1238 Condition E and hexane extractables less than 1.5 wt %, said skin layer containing less than 7500 ppm of anti-block particulates and said film having an elastic recovery after a 100 % stretch of at least 40 % and providing a normalized holding force per 100 μm thickness pre-stretch at 85 % stretch after an initial stretch of 100 % of at least 20 N/50 mm.

59. Film as claimed in Claim 58 wherein the coefficient of friction is from 0.4 to 0.7 provided by an LLDPE skin layer having density of 0.91 to 0.94 g/cm^3 containing less than 3000 ppm of anti-block particulates.

60. Film as claimed in Claim 58 wherein one or both skin layers comprise an LLDPE made using a single site catalyst (e.g. a metallocene) having a tensile test slope of at least 0.01 MPa per % elongation up to 100 % extension.

61. Film as claimed in Claim 58 wherein one or both skin layers contain migratable slip agent to provide a coefficient of friction as defined herein between 0.4 to 0.7 and the main, core layer contains an amount of migratable component to minimize changes in the coefficient of friction by cross-migration of slip agent between the core and skin layers.

62. Film as claimed in Claim 58 wherein one or both skin layers contain non-migratable polymeric surface modifier such as a high molecular weight UHDPE having a molecular weight of above 500 000 and a density of 0.94 or more to

provide a coefficient of friction as defined herein between 0.4 to 0.7 and increased friction under the holding force pressure with a palletized load.

63. Film as claimed in Claim 58 wherein an intermediate layer is interposed between the core layer and one or both skin layers, said intermediate layer being a polymer composition having a modulus more than 40, optionally more than 50 MPa below that of the adjacent skin layer.

64. Film as claimed in Claim 58 wherein the skin layers have different contents of additives selected from the group consisting of anti-block, slip and surface modifier additives.

65. Film as claimed in Claim 58 wherein the core layer comprises a polymer having units derived from ethylene, said polymer having:

a) a Melt Index of from 0.05 to 20 g/10 min as determined by ASTM-1238 Condition E;

b) at least 10 per 1000 C-atoms of short chain branches, containing five carbon atoms or less, as determined by C13 NMR, and less than 3.5 mol % of units derived from a copolymerizable ethylenically unsaturated ester,

c) a density of from 0.90 to 0.94 g/cm^3, preferably 0.91 to 0.935 g/cm^3, especially 0.92 to 0.93 g/cm^3 as determined by ASTM D1505, and

d) a relaxation time as described herein of at least 10 s.

66. Film as claimed in Claim 65 wherein the polymer for the core layer contains at least four short chain branches per thousand carbon atoms containing three carbon atoms or less.

67. Film as claimed in Claim 65 wherein the polymer for the core layer contains at least five short chain branches per thousand carbon atoms containing three carbon atoms or less.

5   68. Film as claimed in Claim 65 wherein the polymer for the core layer contains less than 30 per 1000 C-atoms of short chain branches, containing five carbon atoms or less, as determined by C13 NMR.

69. Film as claimed in Claim 65 wherein the polymer for the core layer contains less
10   than 20 per 1000 C-atoms of short chain branches, containing five carbon atoms or less, as determined by C13 NMR.

70. Film as claimed in Claim 65 wherein the polymer for the core layer contains from 1 to 3 mol % of units derived from a copolymerizable ethylenically unsaturated
15   ester.

71. Film as claimed in Claim 65 wherein the polymer for the core layer contains at least 1 per 1000 C-atoms of all long chain branches, containing 6 or more carbon atoms as determined by C13 NMR.
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72. Film as claimed in Claim 65 wherein the polymer for the core layer contains at least 5, per 1000 C-atoms of all long chain branches, containing 6 or more carbon atoms as determined by C13 NMR.

25   73. Film as claimed in Claim 65 wherein the polymer for the core layer contains from 1 to 3 mol % of units derived from a copolymerizable ethylenically unsaturated ester and at least 1 per 1000 C-atoms of all long chain branches, containing 6 or more carbon atoms as determined by C13 NMR.

74. Film as claimed in Claim 65 wherein the polymer for the core layer has a bimodal molecular weight distribution as determined by GPC DRI.

75. Film as claimed in Claim 65 wherein the polymer for the core layer has a relaxation time is less than 20 s.

76. Film as claimed in Claim 65 wherein the polymer for the core layer has a Melt Index of less than 15 g/10 min.

77. Film as claimed in Claim 65 wherein the polymer for the core layer has a Melt Index of less than 10 g/10 min.

78. Film as claimed in Claim 65 wherein the polymer for the core layer has a Melt Index of from 0.1 to 4 g/10 min for blown film extrusion.

79. Film as claimed in Claim 65 wherein the polymer for the core layer has a Melt Index of less than 2 g/10 min.

80. Film as claimed in Claim 65 wherein the polymer for the core layer has a Melt Index of less than 1 g/10 min.

81. Film as claimed in Claim 58 wherein the polymer for the core layer is obtained by free radical polymerization using a chain transfer agent that incorporates into the polymer chain such as an alpha-olefin to provide a polymer having a Melt Index of from 0.05 to 20 g/10 min as determined by ASTM-D 1238 Condition E; and at least 10 per 1000 C-atoms of short chain branches, containing five carbon atoms or less, as determined by C13 NMR.

82. Film as claimed in Claim 81 wherein the polymer for the core layer comprises less than 3.5 mol % of units derived from a copolymerizable ethylenically unsaturated ester.

5   83. Film as claimed in Claim 81 wherein the polymer for the core layer is produced in a tubular reactor under circumstances to favor LCB formation in a down stream part of the tubular reactor and has a density of from 0.90 to 0.94 g/cm^3.

84. Film as claimed in Claim 81 wherein the polymer for the core layer has a density

10   of 0.91 to 0.935 g/cm^3 as determined by ASTM D1505, and a relaxation time as described herein of at least 10 s.

85. Film as claimed in Claim 81 wherein the polymer for the core layer has a density of 0.92 to 0.93 g/cm^3 as determined by ASTM D1505.

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86. Film as claimed in Claim 81 wherein the polymer for the core layer contains at least four short chain branches per thousand carbon atoms containing three carbon atoms or less.

20   87. Film as claimed in Claim 81 wherein the polymer for the core layer contains at least five short chain branches per thousand carbon atoms containing three carbon atoms or less.

88. Film as claimed in Claim 81 wherein the polymer for the core layer contains less

25   than 30 per 1000 C-atoms of short chain branches, containing five carbon atoms or less, as determined by C13 NMR.

89. Film as claimed in Claim 81 wherein the polymer for the core layer contains less than 20 per 1000 C-atoms of short chain branches, containing five carbon atoms or less, as determined by C13 NMR.

5   90. Film as claimed in Claim 81 wherein the polymer for the core layer contains from 1 to 3 mol % of units derived from a copolymerizable ethylenically unsaturated ester.

91. Film as claimed in Claim 81 wherein the polymer for the core layer contains at

10   least 1 per 1000 C-atoms of all long chain branches, containing 6 or more carbon atoms as determined by C13 NMR.

92. Film as claimed in Claim 81 wherein the polymer for the core layer contains at least 5, per 1000 C-atoms of all long chain branches, containing 6 or more carbon

15   atoms as determined by C13 NMR.

93. Film as claimed in Claim 81 wherein the polymer for the core layer contains from 1 to 3 mol % of units derived from a copolymerizable ethylenically unsaturated ester and at least 1 per 1000 C-atoms of all long chain branches, containing 6 or

20   more carbon atoms as determined by C13 NMR.

94. Film as claimed in Claim 81 wherein the polymer for the core layer has a bimodal molecular weight distribution as determined by GPC DRI.

25   95. Film as claimed in Claim 81 wherein the polymer for the core layer has a relaxation time is less than 20 s.

96. Film as claimed in Claim 81 wherein the polymer for the core layer has a Melt Index of less than 15 g/10 min.

97. Film as claimed in Claim 81 wherein the polymer for the core layer has a Melt Index of less than 10 g/10 min.

5 98. Film as claimed in Claim 81 wherein the polymer for the core layer has a Melt Index of from 0.1 to 4 g/10 min for blown film extrusion.

99. Film as claimed in Claim 81 wherein the polymer for the core layer has a Melt Index of less than 2 g/10 min.

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100. Film as claimed in Claim 81 wherein the polymer for the core layer has a Melt Index of less than 1 g/10 min.

101. Film as claimed in Claim 58 wherein the polymer for the core layer is 15 produced using a free radical polymerization process comprising feeding ethylene and a copolymerizable ethylenically unsaturated ester and propylene as a chain transfer agent, under conditions favoring formation of short chain branches by backbiting and propylene incorporation to provide a polymer having a Melt Index of from 0.05 to 20 g/10 min as determined by ASTM-D 1238 Condition E.

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102. Film as claimed in Claim 101 wherein the polymer for the core layer comprises less than 3.5 mol % of units derived from a copolymerizable ethylenically unsaturated ester.

25 103. Film as claimed in Claim 101 wherein the polymer for the core layer is produced in a tubular reactor under circumstances to favor LCB formation in a down stream part of the tubular reactor and has a density of from 0.90 to 0.94 g/cm^3.

104.   Film as claimed in Claim 101 wherein the polymer for the core layer has a density of 0.91 to 0.935 g/cm^3 as determined by ASTM D1505, and a relaxation time as described herein of at least 10 s.

5   105.   Film as claimed in Claim 101 wherein the polymer for the core layer has a density of 0.92 to 0.93 g/cm^3 as determined by ASTM D1505.

106.   Film as claimed in Claim 101 wherein the polymer for the core layer has at least 10 per 1000 C-atoms of short chain branches, containing five carbon atoms
10   or less, as determined by C13 NMR, and less than 3.5 mol % of units derived from a copolymerizable ethylenically unsaturated ester,

107.   Film as claimed in Claim 101 wherein the polymer for the core layer contains at least four short chain branches per thousand carbon atoms containing three
15   carbon atoms or less.

108.   Film as claimed in Claim 101 wherein the polymer for the core layer contains at least five short chain branches per thousand carbon atoms containing three carbon atoms or less.
20

109.   Film as claimed in Claim 101 wherein the polymer for the core layer contains less than 30 per 1000 C-atoms of short chain branches, containing five carbon atoms or less, as determined by C13 NMR.

25   110.   Film as claimed in Claim 101 wherein the polymer for the core layer contains less than 20 per 1000 C-atoms of short chain branches, containing five carbon atoms or less, as determined by C13 NMR.

111. Film as claimed in Claim 101 wherein the polymer for the core layer contains from 1 to 3 mol % of units derived from a copolymerizable ethylenically unsaturated ester.

112. Film as claimed in Claim 101 wherein the polymer for the core layer contains at least 1 per 1000 C-atoms of all long chain branches, containing 6 or more carbon atoms as determined by C13 NMR.

113. Film as claimed in Claim 101 wherein the polymer for the core layer contains at least 5, per 1000 C-atoms of all long chain branches, containing 6 or more carbon atoms as determined by C13 NMR.

114. Film as claimed in Claim 101 wherein the polymer for the core layer contains from 1 to 3 mol % of units derived from a copolymerizable ethylenically unsaturated ester and at least 1 per 1000 C-atoms of all long chain branches, containing 6 or more carbon atoms as determined by C13 NMR.

115. Film as claimed in Claim 101 wherein the polymer for the core layer has a bimodal molecular weight distribution as determined by GPC DRI.

116. Film as claimed in Claim 101 wherein the polymer for the core layer has a relaxation time is less than 20 s.

117. Film as claimed in Claim 101 wherein the polymer for the core layer has a Melt Index of less than 15 g/10 min.

118. Film as claimed in Claim 101 wherein the polymer for the core layer has a Melt Index of less than 10 g/10 min.

119.   Film as claimed in Claim 101 wherein the polymer for the core layer has a Melt Index of from 0.1 to 4 g/10 min for blown film extrusion.

120.   Film as claimed in Claim 101 wherein the polymer for the core layer has a
5   Melt Index of less than 2 g/10 min.

121.   Film as claimed in Claim 101 wherein the polymer for the core layer has a Melt Index of less than 1 g/10 min.

10   122.   Film as claimed in Claim 58 wherein the skin layers constitute jointly from 10 to 60 % of the overall film thickness, preferably from 30 to 50 %.

123.   Film as claimed in Claim 58 made by blown film extrusion in seamless tubular form adapted to form a stretch hood upon transverse direction capable of
15   extension to at least 100 % and subsequent elastic relaxation.

124.   Stretch hood packaging process using a film having a coefficient of friction of from 0.2 to 1 comprising:
        a)   a core polymeric layer; and
20   b)   a skin layer, on each side of the core which may be of the same or different composition, comprising at least 60 wt % of an LLDPE having density of 0.91 to 0.94 g/cm^3 as determined by ASTM-D 1238 Condition E and hexane extractables less than 1.5 wt %, said skin layer containing less than 7500 ppm of anti-block particulates and said film having an elastic recovery after a 100 % stretch of at
25   least 40 % and providing a normalized holding force per 100 µm thickness pre-stretch at 85 % stretch after an initial stretch of 100 % of at least 20 N/50 mm.